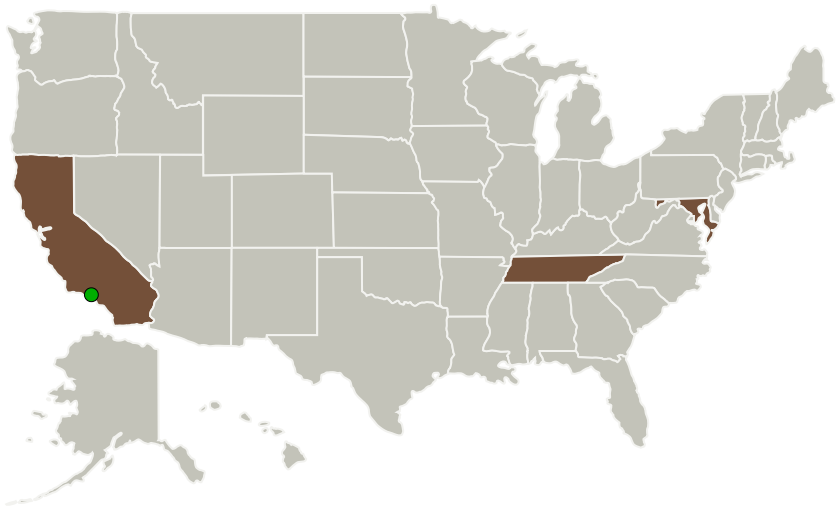
High Performance Image Processing Algorithms for Current and Future Mastcam Imagers, Phase I

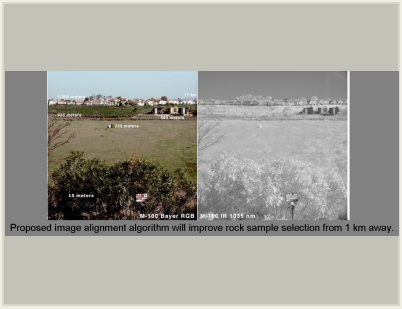
Completed Technology Project (2016 - 2017)

Project Introduction

We propose high performance image processing algorithms that will support current and future Mastcam imagers. The algorithms fuses the acquired Mastcam stereo images at different wavelengths to generate multispectral image cubes which can then be used for both anomaly detection and rough composition estimation from relatively longer distances when compared to LIBS instrument. To address the challenge in the stereo image alignment, we propose a two-step image registration approach. The first step consists of using the well-known RANSAC (Random Sample Consensus) technique for an initial image registration. The second step uses this roughly aligned image with RANSAC and the left camera image and applies a Diffeomorphic registration process. Diffeomorphic registration is formulated as a constrained optimization problem which is solved with a step-then-correct strategy. This second step allows to reduce the registration errors to subpixel levels and makes it possible to conduct reliable anomaly detection and composition estimation analyses with the constructed multispectral image cubes. Finally, in this framework, we provide a set of both conventional and state-of-the-art anomaly detection and composition estimation techniques to be applied to the generated Mastcam multispectral image cubes for guiding the Mars rover to interesting locations.

Primary U.S. Work Locations and Key Partners





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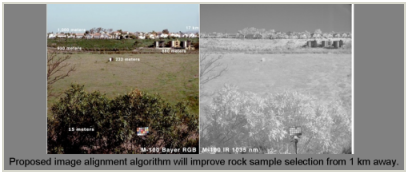
Organizations Performing Work	Role	Type	Location
Applied Research, LLC	Lead Organization	Industry Minority-Owned Business	Rockville, Maryland
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California
The University of Tennessee-Knoxville(UT-K)	Supporting Organization	Academia	Knoxville, Tennessee

Primary U.S. Work Locations	
California	Maryland
Tennessee	

Images



Briefing Chart Image
High Performance Image Processing Algorithms for Current and Future Mastcam Imagers, Phase I
(https://techport.nasa.gov/image/133839)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Applied Research, LLC

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

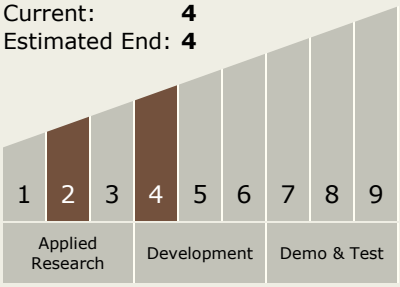
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Chiman Kwan

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX02 Flight Computing and Avionics
  - TX02.2 Avionics Systems and Subsystems
    - TX02.2.7 Data Reduction Hardware Systems